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FOR

**METHOD AND APPARATUS FOR REMOTE CONTROL**

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## METHOD AND APPARATUS FOR REMOTE CONTROL

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### Background of the Invention

#### Field of the Invention

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The present invention relates generally to the field of interfaces between humans and machines, and more particularly to methods and apparatus for facilitating communication between a user and one or more devices which are remote from the user.

#### Background

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Over the past several decades there has been a widespread adoption by consumers of various types and pieces of electronic entertainment equipment. Devices such as televisions (TV), set-top boxes, radio receivers, video cassette recorders (VCR), compact disk (CD) players, digital versatile disk (DVD) players, and similar consumer electronic devices have become common in many households.

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Many of these modern consumer electronic devices are designed to be operable by remote control. In the earliest versions of remotely controlled consumer electronic devices, a wired connection between the device, a TV for example, and a hand-held control unit was provided. Although the hand-held control unit was remote from the device under control, in this case a TV, it was nonetheless cumbersome and undesirable to have a wire between the two. In view of this disadvantage, hand-held control units were subsequently developed which possessed a wireless link to the consumer electronic device which they controlled. Although any suitable wireless communication link

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5 may be used between a device and its corresponding remote control unit, such links are most commonly implemented today by way of an infrared transmitter and receiver.

Over time consumers tended to acquire a greater number of entertainment devices, each individually operable by remote control. These  
10 collections of entertainment devices were often aggregated in a single area of a room, and such an aggregation may be, but is not required to be, referred to as an entertainment center. A disadvantage of such an arrangement is that the user was then required to handle several different remote control devices in order to operate the various components in the entertainment center. For  
15 example, in an entertainment center which comprised an aggregation of a TV, set-top box, and CD player, there was also a remote control for the TV, a remote control for the set-top box, and a remote control for a compact disk player, and each of these separate remote controls would need to be used to operate the entertainment center.

20 In order to overcome the undesirable situation of having many remote control units to properly control an aggregation of individually controllable electronic devices, a more advanced form of hand-held remote control unit was developed. These more advanced remote control units were each capable of operating more than one electronic device. Such remote control  
25 units are typically referred to as universal remote controls.

Universal remote controls may be programmed to transmit the control codes recognized by two or more pieces of electronic equipment. However, since many functions, such as for example, "Power-On" or "Power-Off", are shared by each of the several devices to be controlled, the universal remote  
30 control units are typically provided with buttons that are used to select which one of the two or more of control codes (each recognized by a particular piece of equipment) is to be transmitted by the universal remote control.

5           What is needed is a universal remote control unit that provides an easy to operate interface with the user.

### **Summary of the Invention**

Briefly, methods and apparatus in accordance with the present  
10   invention facilitate communication between a user and one or more devices which are remote from the user, reduce the number of required button presses, or keystrokes, and further reduce keystroke errors, by including the ability to associate a user selected default device with a particular set of buttons or keys.

15           In one aspect of the present invention, a remote control unit having a user interface that includes buttons, or keys, determines which one of several function classes a particular button or key is associated with, and based, at least in part, on the determination of the function class, the remote control unit selects a control code for transmission to a device from which it is physically  
20   spaced apart.

In a further aspect of the present invention, a method of transmitting information from a first device to a second device, includes, receiving a user input at the first device, determining a class to which the user input belongs, identifying one of a plurality of sets of information which is associated with the  
25   class, looking up at least one datum in the identified set of information, and transmitting the datum.

In a still further aspect of the present invention, a remote control unit, includes a user input signal source, a classifier coupled to the user input signal source, an address generator coupled to receive input from the user  
30   input signal source and the classifier, a control code memory coupled to receive input from the address generator, and a transmitter coupled to receive input from the control code memory.

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## **Brief Description of the Drawings**

Fig. 1 is a schematic block diagram of a remote control unit and several consumer electronic devices arranged as an entertainment center.

Fig. 2 shows an illustrative grouping of enumerated function buttons into function classes.

10 Fig. 3 is a flowchart showing the operations in a process in accordance with the present invention.

Fig. 4 is a flowchart showing the operations in a process in accordance with the present invention.

15 Fig. 5 is a block diagram showing a system architecture including a schematic representation of a set of input buttons on a universal remote control unit, and several tables contained in the memory of such a universal remote control unit that may be used for classifying a user input within a particular function class and generating a classification code, determining  
20 which device is associated with the classification code and accessing the control code or codes needed to send the command indicated by a button press to the device which has a programmed association with the function class to which the button belongs.

25 Figs. 6A, 6B, and 6C are flowcharts of a process for setting up and utilizing, the programmed association feature in a specific embodiment of the present invention.

Fig. 7 is a flowchart of a process for disabling the programmed association feature in a specific exemplary embodiment of the present invention.

30 Fig. 8 is a flowchart of a process for enabling the programmed association feature in a specific exemplary embodiment of the present invention.

### Detailed Description

Most universal remote control units are concurrently capable of operating, that is supplying control information to, more than one type of audio and/or video (A/V) device. Because of the capability to operate, or control, many different devices, it is necessary from a practicality standpoint, that many of the buttons, or keys, of the conventional universal remote control unit be shared for controlling different devices. For example, a "Power-On" command, might be intended for a set-top box, or a TV, or a DVD player, or a radio receiver. It has been demonstrated that a problem with conventional universal remote controls is that because many buttons must be shared by more than one device it is sometimes difficult for a user to achieve the desired result. For example, if a conventional universal remote control can operate a device such as a TV and a VCR, both devices will share the POWER button, the number buttons (0-9), and the Channel Up and Channel Down buttons. The user must select the device to be operated by pressing a specific selection button prior to pressing one of the above mentioned control buttons. If the user fails to press the correct selection button, the control function code for the wrong device will be transmitted. In addition to failing to press a required button, the user may press an incorrect button, or key.

Accordingly, there is a need for a universal remote control unit in which fewer keystroke errors are encountered and in which fewer button presses are required. Embodiments of the present invention provide methods and apparatus for overcoming such deficiencies of conventional universal remote control units.

Reference herein to "one embodiment", "an embodiment", or similar formulations, means that a particular feature, structure, or characteristic described in connection with the embodiment, is included in at least one embodiment of the present invention. Thus, the appearances

5 of such phrases or formulations herein are not necessarily all referring to the same embodiment. Furthermore, various particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

The terms, set-top box and cable-box are sometimes used  
10 interchangeably in this field. Both may be referred to as being “analog” or “digital” depending upon their particular internal circuit configurations. Both typically serve as an interface between a broadband signal source, such as but not limited to a broadband cable, and one or more consumer electronic devices such as, but not limited to, TVs and VCRs. Both typically further  
15 include an interface between themselves and one or more remote control units. Such remote control units allow a user to provide control information to the boxes. Such control information may include, but is not limited to commands such as power-on, power-off, channel-up, channel-down, volume-up, volume-down, mute, and so on.

20 Referring now to Fig. 1, a schematic block diagram is shown which illustrates an entertainment center **101** and a remote control unit **102**. Remote control unit **102** wirelessly communicates with entertainment center **101** in this example, and such wireless communication is typical of most implementations of the present invention. Entertainment center **101** includes,  
25 but is not limited to, audio/visual equipment such as television **104**, set-top box **106**, VCR **108**, DVD player **110**, CD player **112**, radio receiver **116**, and audio speakers **114**.

In one embodiment of the present invention, a capability is included in a remote control unit which provides a method of programming that remote  
30 control unit to select a particular source when a specific class of button is pressed. Prior to using this method of programming, the user supplies information to the remote control unit regarding the manner in which that

5 user's A/V system is to be controlled. In this context the term 'source' is often  
used to refer to one consumer electronic device out of the aggregation of  
consumer electronic devices in an entertainment center. The term 'source' is  
used because the selected device becomes the source of entertainment  
content. However, the source device may also be referred to as the target  
10 device from the perspective of it being the desired recipient of the control  
information being transmitted by the remote control unit. In view of the fact  
that this disclosure deals with inventive remote control methods and  
apparatus, the term 'target' will be used because it more clearly sets out the  
relationship being described.

15 In this exemplary embodiment, five classes of buttons are defined. A  
first class which includes buttons that control power, a second class which  
includes buttons that control volume, a third class which includes buttons that  
control channel selection, a fourth class of buttons that control transport, and  
a fifth class of buttons that control other miscellaneous functions for which the  
20 remote control unit can supply control codes. Some illustrative examples, but  
not an exhaustive list, of the five classes are provided here. Examples of the  
Power Control class include TV power, VCR power, Cable power, Satellite  
power, and Audio power. Examples of the Volume class include Volume up,  
Volume down, and Mute. Examples of the Channel class include Channel up,  
25 Channel down, the digits 0-9, Enter, and TV/Video. Examples of the  
Transport class include Play, Stop, Fast Forward, Rewind, Pause, and  
Record. Examples of the Miscellaneous class include Audio source select,  
theater effects, and tone control. The present invention is not limited to the  
five classes described here (i.e., Power, Volume, Channel, Transport, and  
30 Miscellaneous), but rather may be supplemented with additional classes as  
desired.

Fig. 2 shows an illustrative grouping of enumerated function buttons  
into function classes. More particularly, grouping **202** shows the Power Class



5 functions: Power, On, and Off. Grouping **204** shows the Volume Control Class functions: Volume Up, Volume Down, and Mute. Grouping **206** shows the Channel Control Class functions: Channel Up, Channel Down, Number buttons (0-9), Previous Channel, and TV/VCR. Grouping **208** shows the Transport Class functions: Play, Stop, Rewind, Fast Forward, Next Channel  
10 (track, chapter, preset), Previous Channel (track, chapter, preset), Record, Pause, and Next. Grouping **210** shows the Control Class functions: Surround, Display, Menu, Guide, Up, Down, Left, Right, and Reset (exit, cancel). It should be noted that various other functions may be added to the appropriate Classes above, and that the Classes shown in Fig. 2 are for  
15 illustrative purposes.

In a further aspect of this embodiment, the remote control unit is programmed for each of the classes once. These programmed settings are retained in a non-volatile memory, such as flash memory, within the remote control unit. Those skilled in the art and having the benefit of this disclosure  
20 will recognize that any suitable non-volatile memory may be used, as may be battery-backed volatile memory. Programming is accomplished in this embodiment as described hereafter. First, a target button, which is located on the remote control unit, (e.g., TV, VCR, CBL, SAT, etc.) is pressed. Next, a programming button is pressed. A programming button is one which, when  
25 depressed, generates, or causes the generation of, the signal or signals needed to have the remote control unit establish a default target for a particular functional class of buttons. Whether such a button is referred to as a 'programming button' or some other name is immaterial. Furthermore, the present invention contemplates a user activating a plurality of buttons either  
30 concurrently or sequentially to obtain the same functionality as a single programming button. Pressing the programming button distinguishes such programming activity from normal operation of the remote control unit.

The next operation in this process is to press a button within the class

5 that is to be associated with the target selected in the first step. In this illustrative embodiment of the present invention, an indicator, such as but not limited to a light emitting diode (LED), on the remote control unit shows that a priority has been successfully programmed. For example, to associate the channel selection function with a cable-box, the CABLE button is pressed,  
10 followed by pressing the PROGRAM button, followed by pressing the CHANNEL UP button. In this illustrative embodiment, the aforementioned sequence of operations may associate all channel selection buttons (e.g., channel up, channel down, 0-9) with the cable box. Although other implementations are possible, for the convenience of the user, a presently  
15 preferred embodiment, as described here, allows all buttons associated with the channel selection function to be assigned, or associated, at once by a single programming operation.

Still referring to the same illustrative embodiment, it should be noted that programming the remote control unit to associate a function class of  
20 buttons with a particular target (i.e., a particular device in an aggregation of consumer electronic devices which is to receive control information from the remote control unit) will, in a presently preferred embodiment, also puts the control logic of the remote control unit into a state, or mode, in which it is assumed that the programmed association between the function class and  
25 target device is to be used. In this embodiment, pressing any target button deactivates the programmed association. It should be remembered that although the "target" device is the target of commands from the remote control unit, it is the source of entertainment content (i.e., audio/visual content). It should also be noted that any suitable alternative for deactivating  
30 the programmed association may be used, including but not limited to, voice commands spoken by the user, and one or more buttons dedicated to at least the function of deactivating the programmed association. Where more than one button is dedicated to at least the function of deactivating the

5 programmed association, various implementations may require sequential or concurrent pressing of those buttons.

In some embodiments, a method exists for reactivating the use of the programmed associations by receiving input from, for example, a button. It should be noted that any suitable alternative for reactivating the programmed association may be used, including, but not limited to, voice commands  
10 spoken by the user. One or more enunciator lights may optionally be used to indicate to the user that the programmed association function is active.

In the situation where: 1) a remote control unit in accordance with the present invention is used; 2) the aggregation of consumer electronic devices  
15 controlled by the remote control unit includes at least two devices which are capable of the channel change function; and 3) when it is required that the channel change function be executed by a device which is not the one subject to the active programmed association; then it is necessary to be able to by-pass, or temporarily deactivate, the active programmed association. Such a  
20 situation may occur when a cable-box has been selected to have the active programmed association with the buttons of the channel change function class and the user desires to have the TV select channels as in the case of recording a program on one channel while watching another channel.

Figs. 3 and 4 are flow diagrams illustrating methods of operating a  
25 universal remote control unit in accordance with the present invention. Referring now to Fig. 3, a user input is detected **302**. User inputs are typically detected as button pushes. The function represented by the user input is then classified **304**. Classification of a function represented by the user input typically involves recognizing which button on the remote control unit has  
30 been pressed and further recognizing whether that button relates to turning power on or off for a particular device, changing a channel, changing the volume of some audio output, controlling a transport operation such as, but

5 not limited to, play or rewind, or relates to some other control function.  
Subsequently, a control code is selected for transmission **306**. Selection of the control code is based, at least in part, on the particular button that is pressed and on the programmed association between the function class to which the button belongs, and a particular source of entertainment content.  
10 For example, if a TV has been selected as the default device to be associated with the Power Class buttons via the programmed association feature of the present invention, and the On button is pressed, then the "Power On" code for the TV, as opposed to the set-top box or any other device, is selected for transmission by the remote control unit. Once the appropriate code is  
15 selected, it is transmitted **308**. Such transmission is typically achieved through the use of an infrared (IR) transmitter, and such IR transmission technology is well-known in this field.

Referring to Fig. 4, an alternative method of operating a universal remote control unit in accordance with the present invention is illustrated.  
20 The universal remote control unit receives a user input **402**. This user input may be provided by voice command or by any other suitable means of communicating with the universal remote control unit. For example, buttons may be pressed, a touchscreen may be accessed, and so on. Based, at least in part, on the user input that is received, the universal remote control  
25 generates a classification code **404**. A first control code, which is a function of the user input and the class to which the user input belongs, is then accessed **406**. The control code is then transmitted **408**. Transmission of control codes is typically achieved by way of an IR transmitter, but is not required to be accomplished in this manner. Any suitable means of wireless  
30 communication between the universal remote control unit and the target A/V device may be used.

Fig. 5 is a block diagram showing a system architecture including a schematic representation of a set of input buttons on a universal remote

5 control unit, and several tables contained in the memory of such a universal remote control unit that may be used for classifying a user input within a particular function class and generating a classification code, determining which device is associated with the classification code and accessing the control code or codes needed to send the command indicated by a button

10 press to the device which has a programmed association with the function class to which the button belongs. More particularly, Fig. 5 shows a universal remote control unit **102**, having a plurality of buttons **104**, and a plurality of groupings **506a**, **506b**, **506c**, **506d** and **506e**, each of which includes one or more buttons **104**. Pressing of the buttons is a typical way for a user to

15 communicate with the universal remote control unit. Groupings **506a**, **506b**, **506c**, **506d** and **506e** may correspond to function classes such as a Power Class, a Channel Change Class, a Volume Change Class, a Transport Class, and a Control Class respectively. A class table **508** is a memory structure within the universal remote control unit which is used for mapping the button

20 presses to function classes. That is, when a button is pressed, one or more electrical signals representative of that button press are generated, and as a function of those one or more signals, a classification code is "looked up". The output of class table **508** as a function of the one or more signals (i.e., the classification code) effectively tells the system to which one of the several

25 function classes that the pressed button belongs. The classification code is then used to access a target table **510** which contains the information that defines the default target device for each function class. For example, if the Mute button is pushed, class table **508** maps this button press information to the Volume Change classification code, and the Volume Change classification code is then mapped by target table **510** the information needed to know what

30 default device has been selected for the Volume Change Class of commands. That is, if the TV has been selected for the Volume Change Class of commands rather than the cable box, then the output of target table **510**

5 provides one or more signals which are used to access the appropriate Volume Change control codes for the TV. The ability to change the contents of target table **510** so that other devices may be associated with any particular function class is one aspect of the programmed association feature of the present invention.

10 In some embodiments of the present invention, the programmed association feature is implemented in software. Various software implementations may also be referred to as firmware. References to software or firmware each refer to having a stored control program executed by associated hardware. When a button on a remote control unit in accordance  
15 with present invention is pressed, the signal or signals generated thereby are interpreted as those representing button presses that are intended to transmit a message to the device(s) under control and those representing button presses that are not intended to transmit a message to the device(s) under control. Button presses that are intended to transmit a message are further  
20 classified, typically via a table lookup operation, as one of five classes, i.e., buttons that control volume; buttons that control channel selection; buttons that control power; buttons that control transport; and buttons that control other miscellaneous functions. If the programmed association feature is active (and not bypassed) this classification is used as an index into a table  
25 with one entry per possible classification. The table contains the starting context or target that the remote control unit should use when buttons of that class are pressed. Contexts, as used herein, are defined to be the type of device that is to receive commands from the remote control unit. Such devices include but are not limited to TVs and cable-boxes.

30 Example of Programmed Association Operation

Figs. 6A, 6B, and 6C are flowcharts of a process for setting up, and utilizing the programmed association feature in a specific exemplary

embodiment of the present invention. More particularly, and referring to Fig. 6A, this process is described beginning with a processor within the universal remote control unit being put into a low-power sleep mode **601**. A button press is then detected **602**. A keypad scanning function **603** generates the signals needed to determine what button was pressed. A decision is made **604** as to whether the program button was pressed or a button requiring the transmission of a command was pressed. If a button requiring transmission of a command was pressed, then a decision is made **605** as to whether on the numeric buttons (i.e., 0-9) was pressed. If a numeric button was pressed then a decision is made **606** as to whether the Program Sequence is equal to one of the values 2, 3, or 4. If the Program Sequence is equal to one of the values 2, 3, or 4, then software is executed **607** that increments the Program Sequence, and updates the DeviceID variable such that the new DeviceID value becomes equal to the previous DeviceID value multiplied by ten, plus the decimal value of the numeric key that was pressed. Additional software is executed **608** that displays on an LCD the digit of the numeric key that was pressed, moves the cursor displayed on the LCD, and flashes the LED one time. The processor then returns to the sleep mode **609**.

If at decision **604** it is determined that the program button was pressed, then one or more control flow instructions are executed **610** to go to software for the specific program function, as is illustrated more fully in Fig. 6C. Referring now to Fig. 6C, the description begins with the program button having been pressed **636**. A decision is then made **637** as to whether the Program Sequence is equal to the value 5. If it is, then the DeviceID variable is saved **644**; the text "Device Saved" is displayed on the LCD and the LED is flashed three times **645**; and the processor returns to sleep mode **646**. If at decision **637** the Program Sequence is not equal to the value 5, then a decision is made **638**, as to whether the Program Sequence is equal to the value 1. If it is, then, at **641**, the DeviceID variable is set to the value 0, and

5 the Program Sequence is set to the value 2. The LCD displays the text “Dev ID \_” and the LED is flashed twice **642**. The processor then returns to sleep mode **643**. If at decision **638**, the Program Sequence was not equal to the value 1, then a decision is made **639** as to whether the Program Sequence is equal to the value 3. If it is, then various system adjustments and display  
10 functions may be executed **640**. If, at **639**, the Program Sequence is not equal to the value 3, then the Program Sequence is set equal to zero **647**, and the processor returns to sleep mode **648**.

Referring now to Fig. 6A, if at decision **605**, it is determined that a numeric button has not been pressed, then a decision is made **611**, as to  
15 whether the Program Sequence is equal to the value 2. If it is, then software is executed **618** that sets the value of the variable Class to the result of the Classify function that is executed with an argument indicative of which button was pressed. Fig. 2 shows a high level representation of exemplary table that can be used by the Classify function. That is, the information representative  
20 of the button that was pressed is compared to the list of buttons in the partitioned list shown in Fig. 2. When a match is found between the specific button that was pressed, and the button codes in the partitioned table, then a value is returned which represents the function class to which the button belongs. As shown at **619** in Fig. 6A, the Program Sequence variable is set  
25 to the value zero, the state of the universal remote control unit is set such that the programmed association feature is enabled, and a programmed association array is set so as to associate the selected function class with the current context, i.e., the presently selected A/V device source (a.k.a., the target of the control commands for that function class). Setting the state of  
30 the universal remote control unit is typically achieved by setting the binary state of one or more storage bits to a predetermined value. Additional software is executed **620**, such that the LED is flashed three times, and text is displayed on the LCD indicating the Priority (i.e., the programmed



5 association) has been set in accordance with the function class to which the pressed button belongs. The processor then returns to sleep mode **621**.

If at decision **611**, it is determined that the Program Sequence variable is not equal to the value 2, then a decision is made **612** as to whether the programmed association feature is enabled. If it is not enabled then control  
10 passes to **622** as shown in Fig. 6B, which is described in detail below. If the programmed association feature is enabled, then software is executed **613** that sets the value of the variable Class to the result of the Classify function that is executed with an argument indicative of which button was pressed. A temporary variable, referred to as temp, is then set equal to the programmed  
15 association array **614**. A decision is then made **615** as to whether a variable, referred to as 'temp source slot' is set to a value representative of being empty. If it is, then control passes to **622** as shown in Fig. 6B, which is described in detail below. If, at 615, 'temp source slot' is not set to the value representative of being empty, then, at 616, the variable Context is set to the  
20 value of the variable temp, and the variable Program Sequence is set to zero. Additional software is then executed 617, such that text is displayed on the LCD indicating which A/V device that the programmed association feature has associated the pressed button. Control then passes to **622** as shown in Fig. 6B, which is described in detail below.

25 Referring now to Fig. 6B, a variable referred to as 'TempContext' is set equal to the value of the variable referred to 'Current slot source' **622**. A pointer to the A/V device currently programmed for this source slot is then looked up **623**. A decision is then made **624**, as to whether any pointer exists. If a pointer does exist, then a variable referred to as 'IR Compression  
30 Type' is set equal to the value of the pointer **625**. At **626** control is passed to one of several IR Expander routines as a function of the contents of variable IR Compression Type. Operations **627** through **635**, described below, provide a more detailed description of the IR Expander functionality, which is

5 not a requirement of the present invention. IR Expander functionality is useful for reducing the amount of memory storage capacity that is needed for a particular implementation of the built-in library of control codes in a universal remote control unit. If, at **624**, it is determined that a pointer does not exist, then at **629** the press-through function is executed, and at **630** the variable  
10 TempContext is set to the next source slot. A decision is then made **631** as to whether the value of the variable TempContext is the same as the value for the starting source slot. If it is, then the processor returns to sleep mode **632**. If, at **631**, it is determined that the variable TempContext is not the same as the value for the starting source slot, then control passes back to operation  
15 **623**.

Still referring to Fig. 6B, a representative one of several specific IR expander routines is entered at **627**. A decision is made **628** as to whether the function associated with the button which was pressed actually exists for the selected device. For example, the rewind and fast forward Transport  
20 Class functions do not exist for a TV. If the function does not exist, then control is passed to the operation at **629**. If the function does exist, then the control code for the selected device and function, which was stored in the universal remote control unit, is expanded (i.e., decompressed) **633**, and then transmitted by an infrared transmitter which is part of the universal remote  
25 control unit **634**. The processor then returns to sleep mode **635**.

Fig. 7 is a flowchart of a process for disabling the programmed association feature of a universal remote control unit in a specific exemplary embodiment of the present invention. A source button (e.g., TV, VCR, CBL, AUX) is pressed **702**. The state of the universal remote control unit is then  
30 changed to reflect that the programmed association feature has been turned off **704**. This is typically accomplished by the execution of software which changes one or more bits and thereby sets a new context or state of the universal remote control unit. When this state change takes place, additional

5 software is executed **706** which causes: 1) an LED on the universal remote control unit to flash once; and 2) a Liquid Crystal Display (LCD) on the universal remote control unit to display an icon representative of the off-state of the programmed association feature. The universal remote control unit then enters the sleep state **708**.

10 Fig. 8 is a flowchart of a process for enabling the programmed association feature of a universal remote control unit in a specific exemplary embodiment of the present invention. The AUTO button is pressed **802**. It should be noted that use of an "AUTO" button is not a requirement of the present invention, but rather an illustrative embodiment. In some  
15 implementations, that is, embodiments of the present invention, it may be preferable to have a button, or other input mechanism, that is specifically labeled as to its function of reactivating the programmed association feature of the present invention. A determination is then made **804** as to whether the program sequence equals the value 2. If the value is 2 then the Auto-Search  
20 function is executed **814**. If the value is not 2, then a determination is made **806** as to whether the program sequence equals the value zero. If the value is not zero, then the program sequence is set to the value zero **816** and the universal remote control unit enters the sleep state **818**. However, if the value is 0, then the programmed association feature is turned on **808**,  
25 typically by setting or clearing, one or more storage bits. Additionally, software is executed **810** which causes the LCD to display an icon representative of the programmed association feature being turned on. The universal remote control unit then enters the sleep state **812**.

Although most A/V devices share common functionality, they do not  
30 necessarily all use the same command codes to activate their various functions. The universal remote control unit of the present invention includes a built-in library of codes for a wide variety of A/V device models from many different manufacturers. The Auto-Search function helps a user to find the

5 correct code for any particular A/V device such as, for example, those found  
in an entertainment center. When searching for a code using the Auto-  
Search function the user first selects the appropriate device type. For  
example, the TV button will cause a search for codes through a built-in library  
of TV and TV/VCR unit codes; the VCR/DVD button will cause a search for  
10 codes through a built-in library of VCR, TV/VCR unit, and DVD player codes.  
The CBL/SAT button will cause a search for codes through a built-in library of  
cable box and digital satellite service (DSS) receiver codes. The AUX button  
will cause a search for codes through the entire built-in library of codes. If a  
user has difficulty programming device codes or cannot find the correct code  
15 in an associated user manual, then the Auto-Search feature can cycle  
through the available codes automatically to help locate a usable code.

Embodiments of the present invention advantageously provide a  
solution for the problems of conventional universal remote control units. For  
example, a user has a television and a cable-box, and wants the cable-box to  
control the channel selection, but wants the TV to control volume and power.  
20 Without the programmed associations of the present invention, a user might  
pick up the conventional remote control unit and press the power button with  
the intention of turning on the television. Unfortunately, if the previous  
operation of the conventional universal remote control unit was directed to the  
cable-box, then instead of turning on the TV, the cable-box will unintentionally  
25 be turned off. To correct this result, a user with the conventional universal  
remote control unit must press the power button again to turn the cable-box  
back on, press the TV select button, and press the power button a third time  
to turn on the TV. The user must then remember to press the CABLE button  
on the conventional universal remote control unit before the channel selected  
30 from the cable-box can be changed or the TV tuner channel will be changed  
instead. However, with embodiments of the present invention which include  
the programmed association feature, when the power button is pressed, the

5 remote control unit will know to send the power code for the TV. When the channel button is pressed, the remote control unit will know to send the code(s) for the cable-box. When any volume button is pressed, the remote control unit will know to send the code(s) for the TV. This reduces button presses and errors.

10 A Specific Example

The programmed association features of the present invention are also collectively identified with the trademark of Priority Press™ owned by Innotech Systems of Port Jefferson, New York. In this illustrative embodiment of the present invention, the programmed association features are  
15 implemented in a universal remote control unit designed for use in controlling a variety of audio/visual consumer electronic devices such as those commonly found in an entertainment center, and as described above in this disclosure. The programmed association features make using this illustrative remote control unit simpler for a user than conventional remote control units  
20 by reducing or eliminating the need to push the TV, CABLE, VCR, or AUX button every time the user wants to change which device is to be controlled by wireless commands transmitted by the illustrative remote control unit. With the programmed association feature of the present invention, the user decides which entertainment device is to be used for common functions.  
25 After the user then programs the programmed association feature, the common function mentioned immediately above is performed with only one button press.

This illustrative embodiment also includes voice programming, and the present invention acts to simplify voice programming by reducing the number  
30 of button presses required to perform a function.

Once the programmed association features have been programmed, a user, might never need to press the selection buttons such as TV, CBL, VCR,

5 or AUX again. In this illustrative embodiment, information regarding the  
programmed association is stored in a non-volatile memory within the remote  
control unit, and so even if batteries need to be changed, the TV, CBL, VCR,  
or AUX buttons, are not required to be used again. However, in this  
illustrative embodiment, a combination of button presses is used to inform the  
10 remote control unit that the user desires to erase the current settings of the  
programmed association features. In this illustrative embodiment, pre-defined  
programmed associations between button function classes and content  
sources (i.e., command targets) are provided in non-volatile memory by the  
manufacturer. It should be noted that such default settings may also be  
15 provided by any suitable means other than non-volatile memory, such as for  
example, specific logic circuitry included within the inventive universal remote  
control device.

For example, if both the cable box and TV can control volume, a user  
may have the illustrative universal remote control unit automatically select the  
20 TV whenever the Volume UP, Volume Down, or Mute buttons are pressed,  
while the cable box is automatically selected when the Channel Up, Channel  
Down, or any numeric button is pressed. This is in contradistinction to  
conventional universal remote control units wherein a user must remember to  
press the TV button to change to the TV mode, then change the volume, then  
25 press the CBL button to switch back to the cable mode to continue changing  
the channels.

To set up the programmed association in this illustrative embodiment  
of the present invention, a user presses a device button (e.g., TV, CBL, VCR,  
or AUX), for the device that is to be programmed. A light emitting diode  
30 (LED) that is incorporated into the universal remote control unit of this  
example flashes once to indicate to the user that one of the device buttons  
has been pressed. Next the PROG button is pressed, and the LED flashes  
twice in response to let the user know that the programming mode has been

5 entered. After the PROG button has been pressed, any button in the desired group of function class buttons may be pressed. The LED then flashes three times to indicate to the user that the programming operation has been completed. Any button in the function class group that was selected will now control the selected device. For example, to set up the programmed  
10 association feature to use the volume commands to control the TV, the TV button, the PROG button, and the Volume Up button are pressed sequentially. In another example, to automatically select the cable box whenever it is desired to change channels, the CBL button, the PROG button, and the Channel Up button are pressed sequentially.

15 The programmed association feature classifies buttons of each common type (i.e., function class) together. The classifications in this example are: volume-related buttons; channel-related buttons; tape/DVD-related buttons, and power-related buttons. Once a user assigns (i.e., associates) any button to a device, all the buttons of that type are  
20 automatically assigned to the same device. For example, if the Channel Up button is assigned to the cable box, then the Channel Down, Previous, and numeric buttons are all assigned to the cable box. Similarly, if the user assigns the Volume Up button to the TV, then the Volume Down, and Mute buttons are also assigned to the TV.

25 In this example the programmed association feature can be turned off by pressing any source button (e.g., TV, VCR, CBL, AUX). The programmed association feature may be turned back on by pressing the Auto button. This aspect of the present invention is useful in particular if the user wishes to override the programmed association feature to, for example, record one  
30 channel with the VCR, while watching a different channel with the TV. In this illustrative embodiment the LED will flash once when the programmed association feature is turned overridden. Pressing the Auto button will reactivate, or reinstate, the previous programmed association.

## Conclusion

The examples and descriptions above are provided simply to illustrate the present invention. Those skilled in the art and having the benefit of the present disclosure will appreciate that further embodiments may be  
 10 implemented with various changes within the scope of the present invention.

Embodiments of the present invention provide apparatus and methods for selecting a default device to which control codes are to be transmitted when a button from a particular class of buttons is pressed. Any suitable method of programming the remote control unit so that it knows which  
 15 audio/visual source to select when a particular class of buttons is activated may be used. Similarly, the present invention contemplates any suitable method and apparatus for deactivating and reactivating the programmed association of a function class and an audio/visual source. Although an apparatus in accordance with the present invention is typically a remote  
 20 control unit having buttons to accept input from a user, as discussed above, the present invention is independent of the exact nature of the mechanism by which a user provides such input, and therefore keys, switches, touch-screens, voice recognition, and other suitable means of input may be substituted for buttons in embodiments of the present invention. Voice  
 25 recognition functionality is typically achieved through a combination of hardware and software, although, as will be appreciated by those skilled in the art, a hardware-only voice recognition solution may be used. Whether hardware only, or hardware/software combinations are used to implement voice recognition modules, a microphone is typically included with the voice-  
 30 enabled remote control unit to convert sound waves to electrical signals.

In alternative embodiments of the present invention, a class of buttons may contain a single button, and by extension, every button may be in its own



5 unique class. These class associations may be fixed or programmable. In  
other words, buttons (or any specific input mechanism (including voice  
commands)) are not necessarily divided into classes but are individually  
programmable as to what entertainment content source (i.e., A/V device) is to  
be the first, or priority source when a particular button is pressed. While such  
10 a scheme may be more tedious for a user, since each button would have to  
be programmed, as opposed to each class of buttons, however, such a  
scheme provides greater flexibility and is suitable for covering special cases  
where buttons sometimes have strange mappings in a universal remote  
control unit.

15 An advantage of some embodiments of the present invention is that  
fewer button presses are required to implement some commands.

An advantage of some embodiments of the present invention is that  
fewer keystroke errors are encountered by users.

Various modifications and changes may be made to the above-  
20 described examples which are within the scope of the present invention. For  
example, LEDs may be replaced with incandescent light bulbs, audio alerts,  
or any suitable means for communicating with the user.

Other modifications from the specifically described methods and  
apparatus will be apparent to those skilled in the art and having the benefit of  
25 this disclosure. Accordingly, it is intended that all such modifications and  
alterations be considered as within the spirit and scope of the invention as  
defined by the Claims.